been previously in a very bad pass indeed; but, as far as I know, there is very little that was new even then, except the portion of the work dealing with the lymphatics.

(2) Your reviewer appears not to have apprehended the purpose for which the book was written, viz. to help the ordinary student. To endeavour to teach him how to trace degeneration of nerve fibres "by the invaluable method described by Marchi" is laughingly absurd to any one who has had much acquaintance with histological classes.

(3) Staining in bulk is by no means omitted, the process being carefully described in the chapter on methods, and referred to again and again in the directions for preparation of sections given in the appendices.

(4) I fear your reviewer will "look in vain" again in the second edition of the book for "the methylene-blue method of Ehrlich for showing nerve endings"; for I shall not forsake the principle I have clearly laid down, that it is useless and inadvisable to preach to students what it is impossible, or at least improbable, that they can practise. The work has no ambition to be an up-to-date histologist's *vade-mecum*.

(5) To say that I state that the process of staining with silver nitrate solution "requires from a few hours to a day or two" is to give an entirely false impression. It is distinctly stated that the tissue requires to be subjected to the reagent for from ten to twenty minutes, and then exposed to daylight "for a few hours to a day or two"—a totally different thing. This is quite sufficient, I think, to demonstrate the unfairness of this part of the review.

(6) The statement in the concluding paragraph that the book is "acknowledgedly compiled from other sources" is absolutely untrue. The usual acknowledgment of indebtedness to current literature is made, and the immediate source is given of some of the formulæ; the latter, however, being as much public property as the dates in English history.

(7) Your reviewer is inconsistent in saying at one time that the drawings are "sadly lacking in accuracy," and at another that "they will rejoice the heart of the average student, who will find them just like his specimens." To say that a student would rejoice over a "gaudy" coloured, uninstructive drawing, lacking in accuracy, and having only a superficial resemblance to his specimen, is not only insulting to his intelligence, but is childish in the extreme.

In conclusion: your reviewer charges the book with inaccuracy in the drawings, and also in the text. I take this to mean that both the text and the drawings, as a whole, are inaccurate, because he does not qualify his hostility by one good word from beginning to end. I deny that he can substantiate his charge. I challenge him to do so as publicly as he has made it.

I am glad to say that your review in its unfavourableness stands alone. The rest of the press, both lay and scientific, has spoken well of the work, and I am sure the editor of NATURE will not be under the impression that that valuable paper is the only one enjoying the services of experts for scientific reviews.

ARTHUR CLARKSON.

Marischal College, Aberdeen, June 29.

IN reply to the above, I beg to assure Dr. Clarkson that the bias of which he complains is solely the result of a critical examination of his book. I have no personal knowledge of him, nor any previous reason for thinking ill of him. I will take his paragraphs in succession:—

(1) Comparison with Klein and Noble Smith's "Atlas of Histology." Dr. Clarkson's temerity in endeavouring to put his book on a par with this classical work, which teems with original observations, and the illustrations to which are drawn with the most minute attention to detail, will raise a smile on the lips of every histologist. He is particularly unfortunate in calling attention to his illustrations of the eye and cochlea, which are vastly inferior to those in the "Atlas," although in the sixteen years since that work was published there has been an enormous advance in our knowledge of the structure of these parts, and notably of the retina. I fail to find a sign of this advance either in the text or illustrations.

(2), (3), (4) That the book is intended for the "ordinary student" (I presume that by ordinary student "medical student" is intended), and does not, therefore, require (to use the author's own language) to be "up to date." Dr. Clarkson seems to be under the impression that there is a special kind of scientific knowledge desirable for medical students, and that it is therefore unfair to have judged his book by a rigid scientific standard. I, on the other hand, hold that a book which is sent to a scientific journal for review must be judged on its scientific merits, and must stand or fall upon these. And if I find two of the most valuable modern methods of investigating the structure of the nervous system omitted, and venture to point out their omission, Dr. Clarkson does not, in my judgment, improve his position by the statement that he has purposely committed this blunder, and that it is his intention to perpetuate it.

There may be a "careful description of the process of staining in bulk," but I have failed to find it. There is no mention of Heidenhain's method, which is largely used in all laboratories.

(5) Dr. Clarkson convicts himself, in having misapprehended my criticism. It is precisely the statement that after silver nitrate a tissue "requires from a few hours to a day or two" exposure in water to daylight that I animadverted upon. Every histologist knows, or should know, the detrimental effect of prolonged exposure to light of such preparations.

(6) It is a sufficient answer to this to give Dr. Clarkson's own words. He says in the preface: "The author would acknowledge his indebtedness generally to the current standard works on the subject; and especially to Prof. Stirling's 'Outlines of Histology' for many of the formulæ of reagents." To this I would, however, add that many points besides the formulæ of reagents have a singular resemblance to corresponding points in Stirling, to say nothing of the other "current standard works" to which no name is appended; and, on the other hand, if there is anything original either in the way of descriptions or methods, I at least have been unable to find it.

(7) I have not made merely a general and unsupported accusation of inaccuracy, but I have given specific instances, which might easily be multiplied were it worth the space they would occupy. Since Dr. Clarkson has in his letter made no attempt to explain these, I take it that he admits their justice, and his public challenge becomes a vain piece of bombast.

Finally, I would add that the fact that the rest of the press has spoken favourably of Dr. Clarkson's work is simply an indication that notices of such books are far too frequently drawn up in a careless and perfunctory manner. The injurious effect which such promiscuous eulogy may have upon an author is only too evident from the tone of Dr. Clarkson's letter.

THE REVIEWER.

A Phenomenal Rainbow.

A VERY beautiful rainbow was observed here on the evening of May 26 last, just before sunset. A light easterly air prevailed at the time; but the thin bank of stratus cloud upon which the bow was projected had drifted slowly across from the south-west, and now hung in the eastern sky. The sun was quite low at the time, and during the last two or three minutes before setting was shining through a thin layer of stratus which lay just above the horizon; but there was no apparent diminution in the startling vividness of colour exhibited in the arch. This extraordinary brightness, however, was not the only noticeable feature; immediately below the great arch, and contiguous to it and to each other, were four narrow arches, in which the vivid colours were repeated; these did not reach the horizon, but faded when about three parts of the way down. There was also, some distance above the main arch, a secondary bow, with the four narrow arches appearing again; but here, instead of being below, they were directly above the arch, and, of course, not so bright as the primary set. The whole appearance was curiously like some of the solar phenomena observed in the Arctic sky, and was so beautiful as to attract the attention of several working bushmen, who are not prone to fall into ecstacies over any natural wonders.

The appearance lasted about five minutes, until the sun was below the horizon; a light shower fell at the time. For some days previously the weather had been thundery and unsettled, with variable winds.

H. STUART DOVE.

Table Cape, Tasmania, June 1.

Fire-fly Light.

IN reply to Prof. S. P. Thompson (p. 126), the insect called in German *Johanniskäfer* or *Johanniswürmchen* is certainly the *Lampyris noctiluca* (glow-worm), of which only the female which has no wings, is luminous.

© 1897 Nature Publishing Group

But Prof. Muraoka, in *Wiedemann's Annalen*, describes, as *Johanniskäfer*, a Japanese insect which undoubtedly is not the *Lampyris noctiluca*, but a luminous flying insect, very abundant at the end of June. Therefore it would be a *Luciola*, but a little larger than our famous *Luciola italica*, which appears very numerously in all Italy at the end of June.

Gemminger and Harold mention in Japan two *Luciolæ: Luciola japanica*, Linn., and *Luciola chinensis*, Thunb., but no kind of *Lampyris*. CARLO DEL LUNGO.

R. Liceo Galileo, Florence, Italy, July 11.

THE EVOLUTION OF STELLAR SYSTEMS.[1]

ABOUT a century ago Laplace presented to the world an hypothesis concerning the mechanics of the heavens, basing it on sound dynamical principles, and working it out with that genius which he alone at that time could bring to bear. This hypothesis, grand and general as it was and still is, has made his name familiar to every student of astronomy of to-day; and the equipment of a modern observatory enables us to observe more minutely the stellar systems (which he could not see, but only imagine), and wonder at his far-reaching mind in expounding such a simple scheme of evolution for them. Modern investigations have necessitated, however, a modification of Laplace's original hypothesis. In his time the view was held that figures of equilibrium of rotating bodies were necessarily surfaces of revolution about the axes of rotation, but thanks to the mathematical researches of Jacobi, Darwin, Poincaré, &c., this is found now not to be universally true. To-day, for instance, if we consider the revolution of two separate fluid masses so close to one another that they are caused to coalesce and form a rigid system, through tidal distortions, then the form of the resulting mass will be dumb-bell shaped, approximating to Poincaré's apioid. It is regarding the mutual reaction of two such bodies as these that the author of the volume under consideration has recently made mathematical investigations, and he has not limited himself to the purely mathematical side of the problem, but has extended the view to the stars in space, which according to the ideas now held are not solid bodies, but masses of matter in which tidal action can have full play. It seems exceedingly probable, he says, "that the great eccentricities now observed among double-stars have arisen from the action of tidal friction during immense ages: that the elongation of the real orbits, so unmistakably indicated by the apparent ellipses described by the stars, is the visible trace of a physical cause which has been working for millions of years. It appears that the orbits were originally nearly circular, and that under the working of the tides in the bodies of the stars they have been gradually expanded and rendered more and more eccentric."

Dr. See, in the first of the three chapters which composes this volume of more than 250 pages, gives a short historical sketch of double-star astronomy from the time (1779) of Sir William Herschel down to that of Mr. Burnham. The next three sections are devoted to the solution of several problems referring to Laplace's demonstration of the law of attraction in the planetary systems, investigation of the law of attraction in the stellar systems and the analytical solution of Bertrand's problem based on that developed by Darboux, together with the solution given by Halphen. The three following sections treat of problems which Dr. See has previously published in the *Astronomischen Nachrichten*. In the first of these he develops the theory by which, by a simple spectroscopic observation, the absolute dimensions, parallaxes, and masses of stellar systems may be immediately ascertained assuming the orbits are known from micrometrical measurement. In a later chapter he points out how this method may be applied to the best-known doubles. Those most suitably situated for such measurements of relative motion are: η Cassiopeæ, α Canis Majoris, 9 Argûs, ξ Boötis, γ Coronæ Borealis, Σ 2173, 70 Ophiuchi, β Delphini, and α Centauri. The second section gives us a means of rigorously testing the law of gravitation by comparing the observed motion in the line of sight of a companion with the theoretical value.

Sections 8–12 are devoted to a survey of the chief methods of determining the orbits of binary stars. Among these attention may be drawn to a very simple graphical process of finding the apparent orbit from the given elements. Dr. See also properly brings to the fore that admirable graphical method of solving Kepler's equation which was originally invented by J. J. Waterson, and subsequently rediscovered by Dubois. This method, which Klinkerfues describes in his treatise on theoretical astronomy, and which is used by many continental astronomers, is suited to ellipses of all eccentricities, and can be applied, by the addition of a simply determined correction, to the orbits of comets and planets, giving all the accuracy required.

As regards chapter ii. much could be written, since this part of the volume extends over 178 pages out of the 258, and is of great importance. The author has brought together the detailed researches on the motions of the forty stars whose orbits can be best determined at this epoch. For the completion of this work Dr. See has been able to obtain measurements by double-star observers which have not been previously published, and by this means he has carefully determined independently the orbits of these forty doubles, a piece of work which must have involved an immense amount of labour. In the case of each binary are given the observed measures up to date, the previously determined elements and his own elements, and a comparison of the observed with the computed places. There further follow an ephemeris up to the year 1900, and sometimes up to a later epoch, general remarks on the binary in question, and in each case a plate showing the apparent orbit and the positions of the observed companion.

As an illustration of one of the orbits, we may mention that of 70 Ophiuchi, as this is of special interest since the motion of the comparison indicates that a third body is probably in question. Several investigators have worked out the orbit of this double, but there seems always to have been a certain amount of dissatisfaction about the resulting ellipse. The figure shows very clearly the wavy line of motion of the observed with the computed position. Prof. Schur, who made a most rigorous investigation of this binary in 1868 and 1893, discussing 400 observations in the latter year, inspired the belief that at length a definite orbit was obtained, but subsequent comparison of the observed with the computed positions indicated that there must probably be an unseen body disturbing the elliptic motion. Prof. Burnham, who has specially searched for this third perturbatory body, has as yet failed to see it, although he has used the 36-inch Lick refractor in the attempt.

Coming now to the third and last chapter, Dr. See sums up the results of the researches on these forty binaries. A general glance at the table shows that the elements T, a, ☊, i, λ have no relation to physical causes; but, in the case of the eccentricities, "a most remarkable law" is established, which is "of fundamental importance in our theory of the origin and development of the stellar systems, and is besides of practical value to working astronomers." Perhaps the following table will best show the number of orbits corresponding to different eccentricities:—

---

[1] "Researches on the Evolution of the Stellar Systems. Vol. i. On the Universality of the Law of Gravitation and on the Orbits and General Characteristics of Binary Stars." By T. J. J. See, A.M., Ph.D. (Lynn, Mass, U.S.A.: The Nichols Press, 1896.)

© 1897 Nature Publishing Group